AMENDMENTS TO THE DRAWINGS:

In the Office Action at item 3, the Examiner objected to the drawings. In order to overcome these objections, replacement figures are submitted herewith. In FIGS. 4, 5, 17 and 21 are amended to include quantification notation on the X and Y axes of each of the graphs in the figures.

A set of annotated figures is included herein to clearly illustrate the changes. Approval of these changes as indicated on the replacement figures to the Drawings is respectfully requested.

REMARKS

I. STATUS OF THE CLAIMS

Claims 1 – 34 were pending in the Office Action. Claim 3 and 5 – 34 were withdrawn without prejudice or disclaimer. The Examiner has rejected claims 1, 2 and 4. Claim 35 is added herein. Therefore, claims 1, 2, 4 and 35 are pending and under consideration. The Examiners rejection is traversed below.

II. CLAIMS 1 AND 4 ARE REJECTED UNDER 35 U.S.C. 102(b) AS BEING ANTICIPATED BY AKASAKA ET AL. (US 6,292,288).

The Examiner cites figures 3 and 15; column 8, lines 10 – 35 and column 14, lines 42 – 64 of Akasaka et al. (Akasaka) to assert Akasaka discloses the present invention as recited, for example, in claim 1. The Examiner asserts Akasaka teaches a Raman amplifier for supplying pumping lights to an amplification medium through which is propagated a wavelength division multiplexed signal light obtained by multiplexing a plurality of signal lights of different wavelengths, to amplify the wavelength division multiplexed signal light due to a Raman effect. (citing the Abstract of Akasaka).

Claim 1 of the present invention recites a ***first pumping light generating section*** *that generates a plurality of pumping lights arranged at equal wavelength spacing in a signal light wavelength band where said plurality of signal lights are arranged, which is shifted to a* ***shorter wavelength side*** *in accordance with the wavelength width corresponding to a Raman shift frequency.* Claim 1 further recites *a* ***second pumping light generating section*** *that generates pumping lights of one or more wavelengths arranged in a wavelength band on at least one of a shorter wavelength side and a longer wavelength side than a wavelength band of the pumping lights generated by said first pumping light generating section, the wavelength and power of which are set so that peak wavelength spacing of a Raman gain in the signal light wavelength band is substantially equal to each other.* Akasaka fails to teach *a* ***second pumping light generating section***, as recited in claim 1.

The Examiner appears to refer to figure 3 to assert that the first **group A** of the **pumping means 1** includes semiconductor lasers 3_1 - 3_4 for supplying a plurality of pumping lights from an anterior side to an amplifier fiber 2 that corresponds to the **first** pumping light generating section of the present invention. The Examiner appears to further imply that the

second **group B** of the **pumping means 1** which includes semiconductor lasers 3_5 - 3_8 for supplying a plurality of pumping lights from the posterior sides to the amplifier fiber 2 that corresponds to the **second** pumping light generation section of the present invention. Therefore, the Examiner appears to **imply groups A and B are considered to correspond to the first pumping light generating section and the second pumping light generating section of the present invention respectively**. However, as explained below, the **combination groups A and B only correspond to a first pumping light generation section**. The Examiner further asserts each pumping light supplied by groups A and B of Akasaka are set for a peak of Raman gain corresponding to wavelengths of each of the signal lights respectively. The Examiner further implies the wavelengths of each pumping light is set within a bandwidth which is shifted to a shorter wavelength side in accordance with a wavelength width corresponding to a Raman shift frequency.

More specifically, as indicated in figure 16 and col. 5, line 66 to col. 6, line 4 of Akasaka, the wavelengths λ_{s1} - λ_{s4} of each signal light (monitor signal) shifts wavelengths λ_{p1} - λ_{p4} of each pumping light to a 100nm longer wavelength. Here, a 100nm wavelength shift corresponds to a Raman shift frequency at the 1.5μm band. Also, pumping wavelengths λ_{p1} and λ_{p3} are wavelengths λ_1 and λ_3 in figure 15 and correspond to a wavelength of pump light supplied by group A of figure 3. Similarly, pumping wavelengths λ_{p2} and λ_{p4} are wavelengths λ_2 and λ_4 of figure 15, and correspond to a wavelength of pumping light supplied by group B of figure 3. Therefore, Akasaka teaches **group B is equal to group A**. Thus, the combination of group A and group B corresponds with only the first pumping light generating section as recited in the present invention.

In contrast, claim 1 of the present invention recites, *a* ***second pumping light generating section*** *that generates pumping lights of one or more wavelengths arranged in a wavelength band on* ***at least one of a shorter wavelength side and a longer wavelength side*** *than a wavelength band of the pumping lights generated by said first pumping light generating section, the wavelength and power of which are set so that peak wavelength spacing of a Raman gain in the signal light wavelength band is substantially equal to each other.* The method taught by Akasaka in figures 15 and 16 generates a pumping light having a wavelength that is outside the wavelength band range in which the pumping wavelengths λ_1 - λ_4 exist. Therefore, Akasaka does not teach ***a second pumping light generating section*** *that generates pumping lights of one or more wavelengths arranged in a wavelength band on* ***at least one of a shorter wavelength side and a longer wavelength side*** *than a wavelength band of the*

pumping lights generated by said first pumping light generating section, as recited, for example, in claim 1. Accordingly, the second pumping light generating section, as recited in claim 1 of the present invention, clearly differs from group B of Akasaka. Therefore, Akasaka does not anticipate claims 1 and 4 of the present invention. Withdrawal of the rejection is respectfully requested.

III. CLAIM 2 IS REJECTED UNDER 35 U.S.C. 103(a) AS BEING UNPATENTABLE OVER AKASAKA ET AL.

The Examiner cites column 1, lines 19 – 46 of Akasaka to assert Akasaka discloses the present invention as recited, for example, in claim 2. The Examiner asserts Akasaka teaches that one should use a gain equalizer to reduce the amplitude of gain ripples to under 1dB. (citing colum , lines 19-46 of Akasaka).

Claim 2 depends from claim 1 and is patentable for at least the reasons stated above. Claim 2 further recites *a gain equalizer having the periodicity corresponding to the peak wavelength spacing of the Raman gain in the signal light wavelength band, to reduce the wavelength deviation of the power of the Raman amplified wavelength division multiplexed signal light.*

As set forth in claim 1, a Raman amplification of the wavelength division multiplexed signal light in accordance with a gain wavelength characteristic is possible such that the ***peak wavelength spacing of a Raman gain in the signal light wavelength band is substantially equal to each other*** by providing the second pumping light generating section in addition to the first pumping light generating section. As a result, it becomes possible *to reduce the wavelength deviation of the power of the Raman amplified wavelength division multiplexed signal light* and to resultantly improve the system performance, for example, by utilizing a gain equalizer with a simple configuration and low loss, that has the *periodicity corresponding to the peak wavelength spacing of Raman gain,* as recited in claim 2. Akasaka fails to teach or suggest a gain wavelength characteristic in which ***peak wavelength spacing of a Raman gain in the signal light wavelength band is substantially equal to each other***, as recited, for example, in claim 2. Therefore, claim 2 is patentable over Akasaka. Withdrawal of the rejection is respectfully requested.

IV. NEW CLAIM

New claim 35 is added herein. Support for new claim 35 can be found, for example, on page 12, line 12 – page 13, line 26 of the specification. Claim 35 recites features similar features to claim 1 and should be allowable for at least the reasons stated in section II above. Therefore, it is respectfully submitted that claim 35 is allowable.

V. CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

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FIG.3

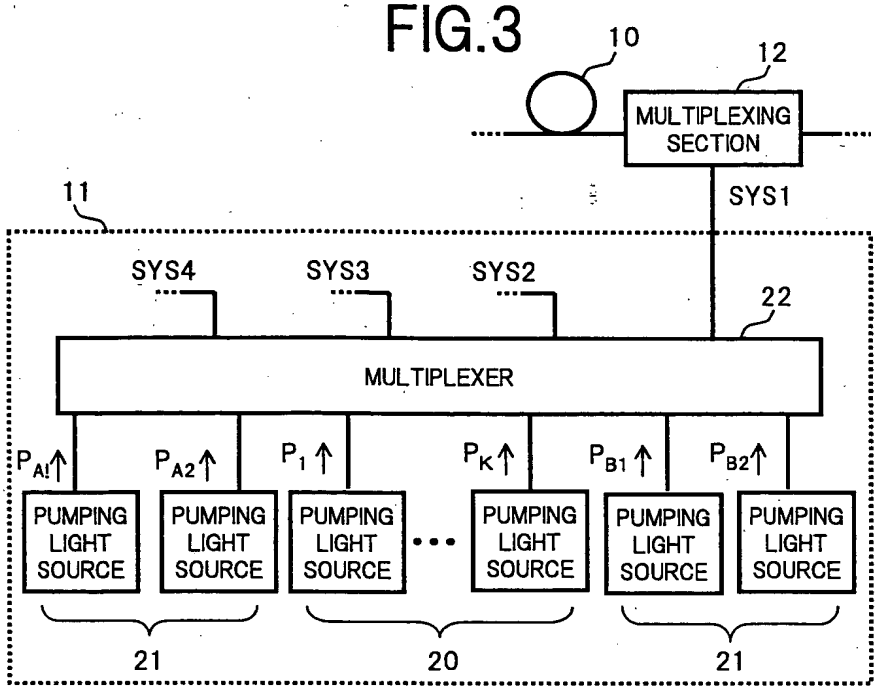

10
12
MULTIPLEXING SECTION
SYS1
11
SYS4
SYS3
SYS2
22
MULTIPLEXER
P_{A1}
P_{A2}
P_1
P_K
P_{B1}
P_{B2}
PUMPING LIGHT SOURCE
PUMPING LIGHT SOURCE
PUMPING LIGHT SOURCE
PUMPING LIGHT SOURCE
PUMPING LIGHT SOURCE
PUMPING LIGHT SOURCE
21
20
21

FIG.4

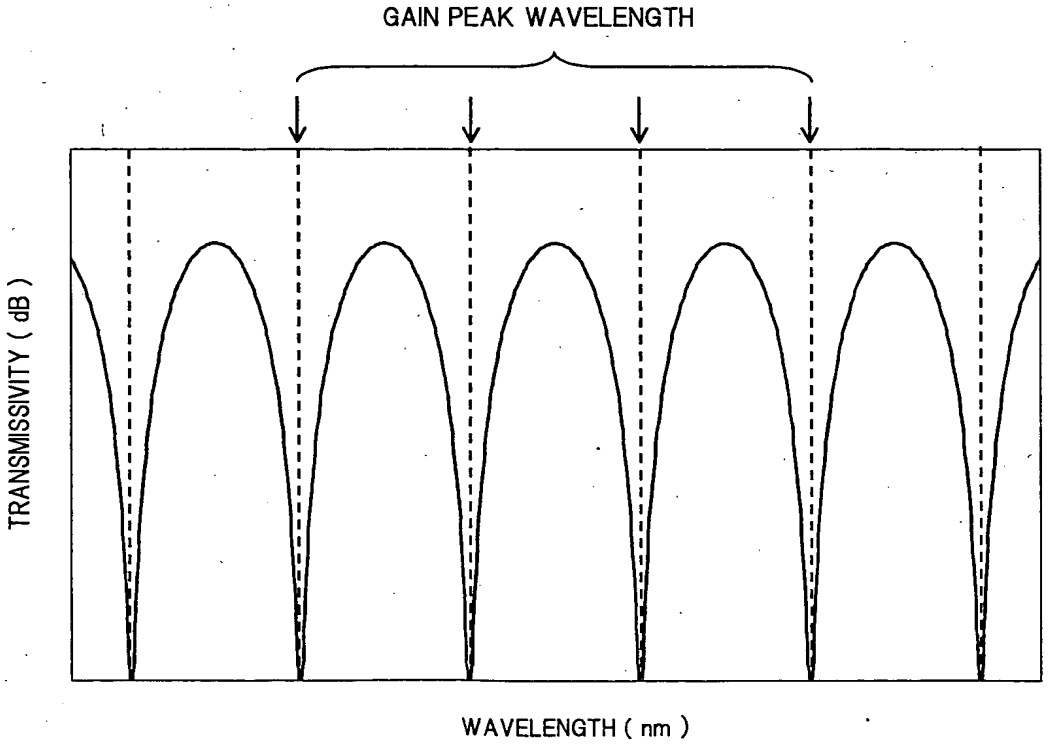

GAIN PEAK WAVELENGTH
TRANSMISSIVITY (dB)
WAVELENGTH (nm)

FIG.5

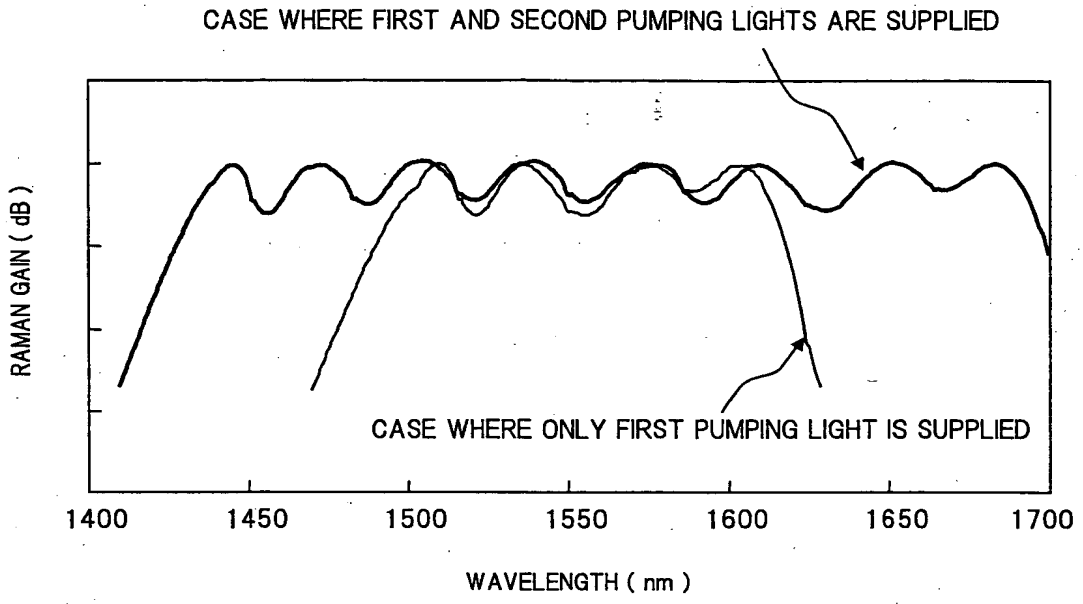

CASE WHERE FIRST AND SECOND PUMPING LIGHTS ARE SUPPLIED
RAMAN GAIN (dB)
CASE WHERE ONLY FIRST PUMPING LIGHT IS SUPPLIED
1400
1450
1500
1550
1600
1650
1700
WAVELENGTH (nm)

FIG.6

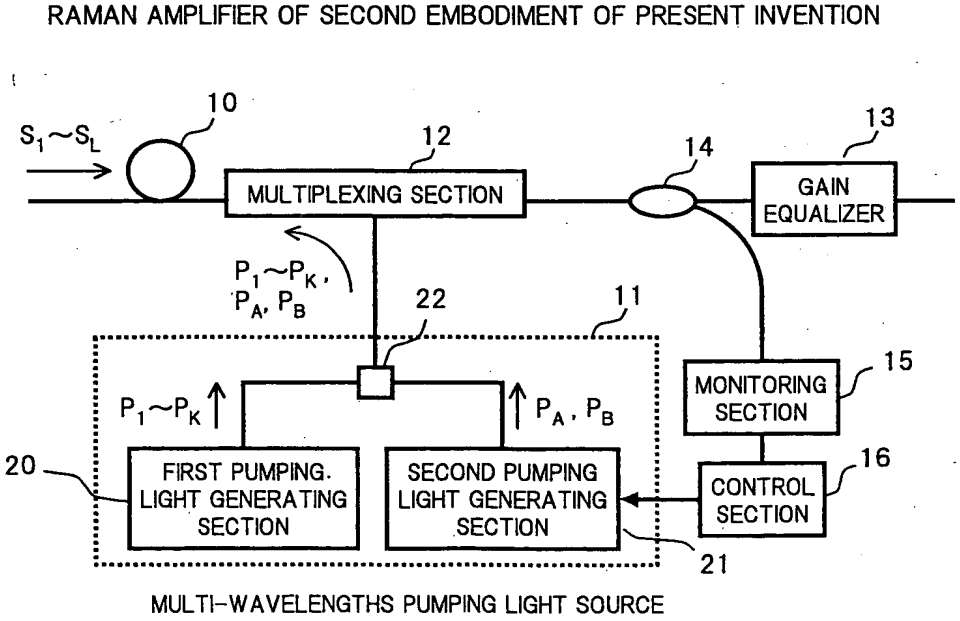

RAMAN AMPLIFIER OF SECOND EMBODIMENT OF PRESENT INVENTION
$S_1 \sim S_L$
10
12
MULTIPLEXING SECTION
14
13
GAIN EQUALIZER
$P_1 \sim P_K$, P_A, P_B
22
11
$P_1 \sim P_K$
P_A, P_B
15
MONITORING SECTION
20
FIRST PUMPING LIGHT GENERATING SECTION
SECOND PUMPING LIGHT GENERATING SECTION
16
CONTROL SECTION
21
MULTI-WAVELENGTHS PUMPING LIGHT SOURCE

FIG.16

RAMAN AMPLIFIER OF FIFTH EMBODIMENT OF PRESENT INVENTION

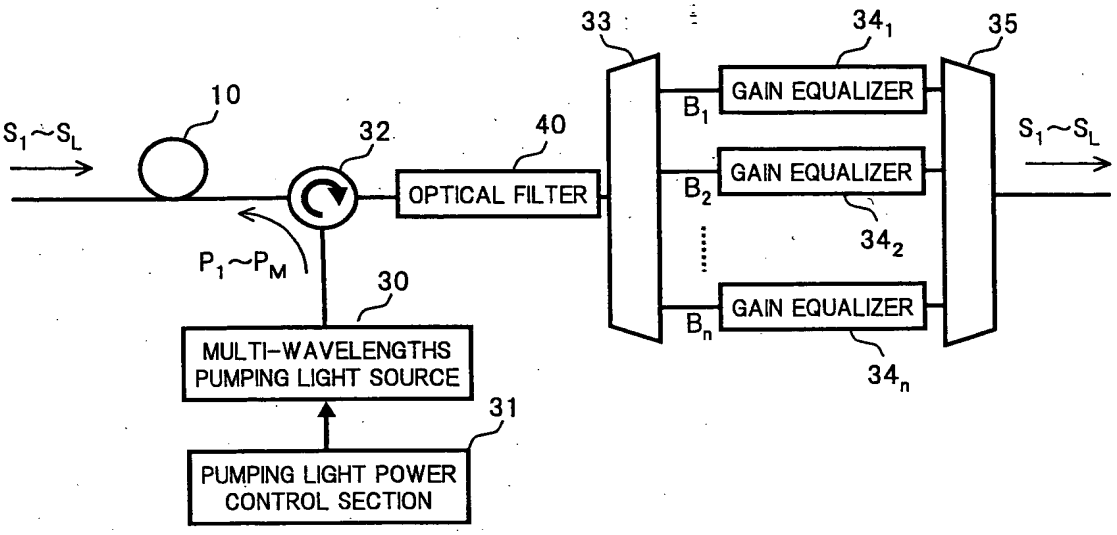


FIG.17

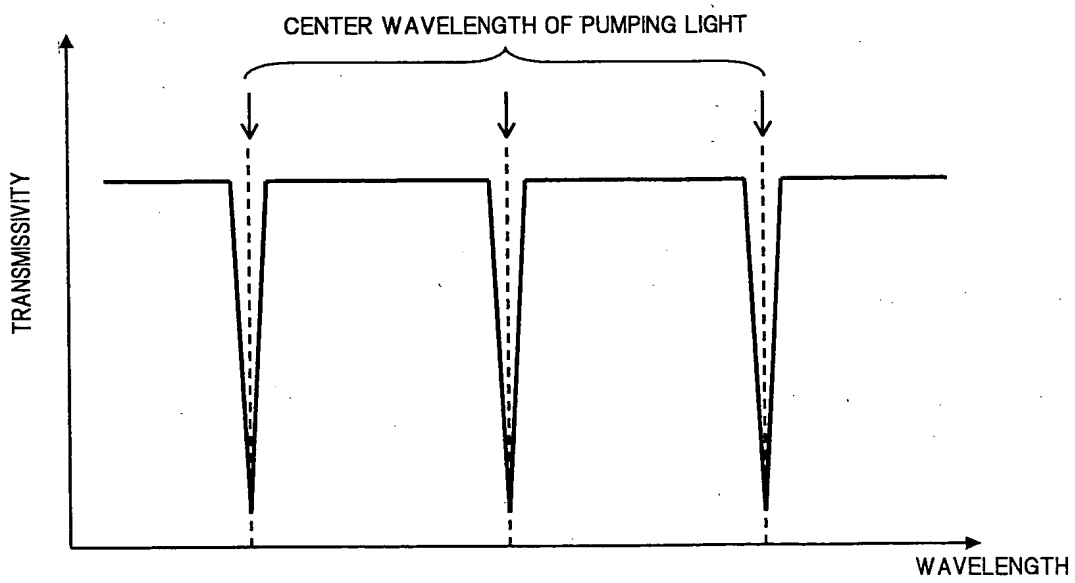


FIG.20

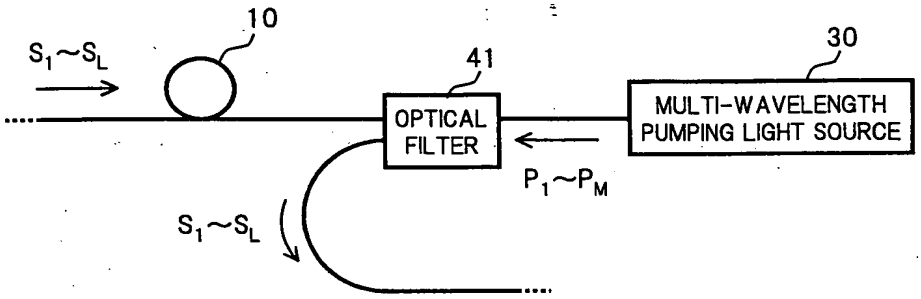
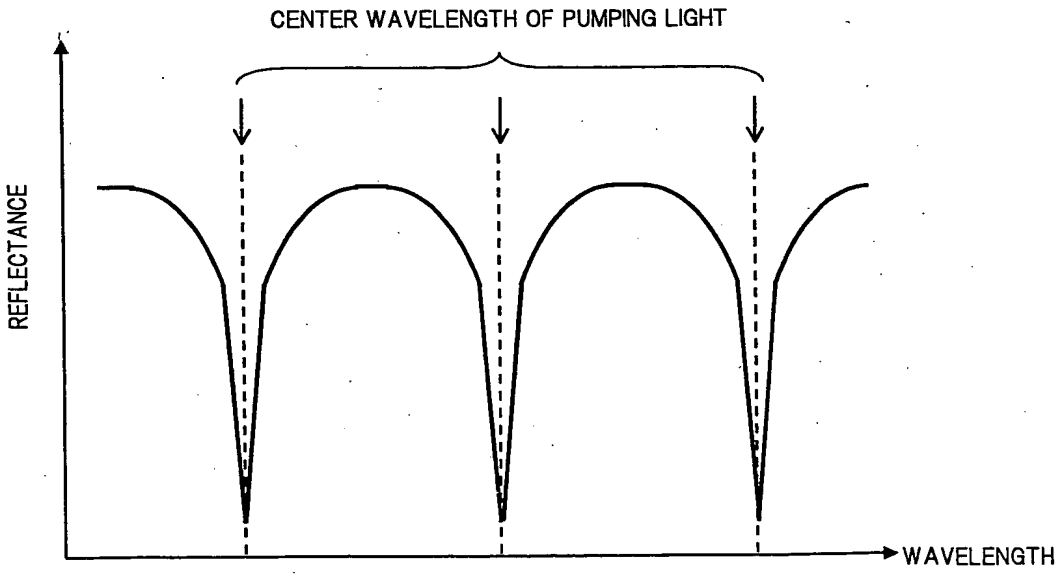

10
$S_1 \sim S_L$
41
30
OPTICAL FILTER
MULTI-WAVELENGTH PUMPING LIGHT SOURCE
$P_1 \sim P_M$
$S_1 \sim S_L$

FIG. 21


CENTER WAVELENGTH OF PUMPING LIGHT
REFLECTANCE
WAVELENGTH